

Learning PC Repair through Web-based Modules

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Abstract: In a time where computers are a commodity and are prevalent throughout the world, there are many who know how to use a computer, yet do not know how to deal with computer issues that arise. Since computer repair is not a common subject taught in schools, where can people learn about it? This instructional design project focused on developing an online instruction that aims to fulfill this void. With web-based, multimedia modules, students in a PC Repair class learned about spyware and viruses, and how to remove them. Although the topic was challenging for participants, test results found that, overall, they were able to comprehend the subject matter. Furthermore, the post-module attitudinal survey revealed that participants were satisfied with the multimedia videos. However, issues and technical difficulties arose and participant frustrations were observed. This and implications of the research are discussed.

Introduction

People have become dependent on computers for daily rituals such as paying bills at home, word processing at school, or emailing at work. What happens if the credit card website no longer loads in the middle of a transaction? What if the word processing program freezes in the middle of a five page essay that hasn't been save? How about if the computer shuts down before an important email goes out? In a time where computers are a commodity and are prevalent throughout the world, there are many who are computer literate, yet do not know how to deal with computer issues that arise such as these. Additionally, as software and hardware technology evolve, users must update their knowledge and learn new skills to adapt to this change. Whether at home, school, or work, computer problems happen to anyone and at any place. Maui Community College is cognizant of this and offers a non-credit course on computer repair to the community so that users can learn to resolve issues in a logical manner. The purpose of this instructional design project is to implement this content online through the design and evaluation of a web based tutorial on PC repair for students at Maui Community College.

Statistics show the reality of computer related problems and how pertinent it is to educate users. According to Consumer Reports' (2009) State of the Net 2009 survey, Spyware infections prompted 545,000 households to replace computers in the past six months and 1 in 7 computers had serious problems due to viruses. The National Cyber Security

Alliance (2008) surveyed K-12 educators and technology coordinators and found that in regard to installing and updating firewalls, anti-virus, anti-spyware and anti-spam software on a computer, "Just more than 2% of educators surveyed said that this is included in state curriculum." It goes on to report that more than 50% of those surveyed indicated they do not know how the topics are taught. This shows that there is a lack of education in regard to this subject matter.

While finding PC repair classes is a problem in itself, classes are usually taught with conventional direct instruction. The problem with this approach is that students may not be engaged in learning nor able to come to a site where such courses are taught. The researcher has taken PC Repair classes from three different instructors in the past and found that they use PowerPoint presentations in their direct lectures. At times, the instructor may demonstrate how to perform a certain task and the students are given an activity worksheet to imitate what the instructor did, but there is little time for practice and limited feedback on the task. With educational technology driving student learning with cutting edge strategies and technologies, it would be suitable to integrate it with computer repair instruction for a more effective learning experience.

This project focuses on learning the fundamentals of viruses and spyware and understanding how to search and remove them from a computer system, a subset of PC Repair. These topics were chosen because of the results of the Consumer Reports' State of the Net 2009 survey and the many recent experiences of people being adversely affected by them. In addition, both viruses and spyware are a serious threat as they can cause grave damage by corrupting invaluable files. They can also render the operating system useless, and consume computing and memory resources making the computer system speed sluggish.

Synopsis of Literature Review

Literature on instructional design, instructional design models, web instruction, and multimedia was reviewed and it was found that instruction that was developed through a systematic process containing elements that engaged the student was discovered to be effective in teaching. The basis of teaching PC repair or any subject is structured by instructional design. According to Siemens (2002), "Instructional Design is the systematic process of translating general principles of learning and instruction into plans for instructional materials and learning." Thus, instructional design aims to develop effective instruction and improve learning outcomes and experiences.

To help understand and implement instructional design, educators, behaviorists, and researchers have created models that revolve around learning and instructional theory. These models provide a sequence of instructional design that can have a positive effect on the instruction's success. A classic instructional design model used by many is The Dick and Carey Model. Dick, Carey, and Carey (2005) stated and claimed, "trust the model-- it has worked for countless students for thirty years." This model consists of nine stages for designing instruction. The authors have stated that this systems approach is appropriate when the instructor delivers the instruction, but have also found that it

recently is also appropriate when instruction includes a computer. Therefore, this model was used as a guide for this project.

Web-based instruction, in particular, has many advantages as it allows students to learn at a time and place that fits around their job and family responsibilities. Additionally, the variety of available web-based teaching tools provides instructional options that are at times superior to those typically available within traditional classrooms (Pucel and Stertz, 2005). Scheines, Leinhardt, Smith, and Cho (2005) performed experiments comparing traditional to online format and measured learning outcomes and student behaviors. They found that "students who entirely replaced going to lecture with doing online modules did as well and usually better than those who went to lecture." Moneta and Kekkonen-Moneta (2007) found web-based instruction to be effective as well. They stated, "The comparisons between online courses and their lecture-based counterparts have so far produced encouraging results: students' performance in the online courses was generally comparable and superior in some cases." Additionally, it "fosters positive learning outcomes and is a valid alternative to lecture-based teaching" (Moneta and Kekkonen-Moneta, 2007).

There were also several strategies that can be implemented into web-based modules to make learning even more effective and engaging. Moneta and Kekkonen-Moneta (2007) found that multimedia is beneficial in the affective domains and stated that "rich interactive multimedia e-learning modules provide unique opportunities for step-by-step learning." This is due to the modality concept of using multiple sensory inputs to gather data. The multimedia principle says that "student understanding can be enhanced by the addition of non-verbal knowledge representations to verbal explanation" (Moreno, R., & Mayer, R., 2007). Thus, the multimodal and multimedia concept will help students learn more effectively as they will be able to process information through multiple senses.

In regard to design elements, Pomales-Garcia and Liu (2006) investigated the impacts of web module length and format and found several discoveries. They identified that there was no difference in recalling information from content; however, the participants were more likely to not complete a module as the length increased to 20 minutes. Thus, module length of about 15 min should suffice for instruction while keeping the learner engaged. Modules with video were perceived to be less difficult and more attractive with the end result of having a high satisfaction. Furthermore, while aesthetics does not diminish information recall it does promote satisfaction. They concluded that "different people learn in different ways, so it is best to present information in many different formats" (Pomales-Garcia & Liu, 2006). Taking into account the various learning styles, various modules were developed that would address the various styles so that every single student can learn in their preferred method of learning.

Methodology

The terminal goal for the entire instructional module is for the audience to learn the fundamentals of viruses and spyware and to understand how to search and remove them from a computer system. Four web-based modules were developed to attain this concept: Spyware Basics, Search and Remove Spyware, Virus Basics, and Search and Remove Viruses. In order to reach the goal, learners received instruction on different components of spyware and virus technology. Each component consists of subskills and accompanying performance objectives within their domain of learning.

The target audience is college students and working adults who are interested in computer technology and, at a minimum, understand the fundamentals of Microsoft Windows operations and navigation. Students have already dealt with computer issues either at home or at work, thus their interest in this subject matter. Those taking this class indicated that they have experienced computer problems either at home or work and want to know how to troubleshoot and mend them in a logical fashion.

The Dick and Carey Model is a classic instructional design model that was used to develop the modules. A Content Analysis Report (CAR) was first devised to find the appropriate skills and learning objectives as well as the matching content presentation, and then it was mirrored onto the instructional website at www.spidaweb.net/pcrepair. Several case studies have found web-based instruction to be effective in learning. In addition, this method of delivery was chosen so that students can access the instructional materials outside of the classroom and at any time convenient to them. The website contains course and contact information as well as the course schedule. In addition, it contains the four instructional modules. Design-wise, it has simple but aesthetically pleasing elements. A blue and green color scheme was used hoping it would ease students' nervousness and help alleviate any stress or anxiety.

As the instructional materials were being developed, the multimedia principle was used to incorporate audio, text, and video to represent content and aid in instruction. Two modules utilized text and images and the other two utilized video and sound. To develop the modules, a Windows laptop was used along with Adobe Dreamweaver to create web pages, Adobe Photoshop to create and edit images, and Camtasia Studio to create multimedia streaming videos. The content was reviewed by a subject matter expert (SME) who is a colleague of the researcher. They both went through undergraduate school together and have worked at the same Information Technology-based company for several years. His wisdom and suggestions were utilized to improve the modules.

This research project was conducted on January 30, 2010 in an established educational setting and involved normal educational practices. Instruction took place in a classroom outfitted with computers and a projector at Maui Community College. The researcher had permission to work in this environment and has been doing so for the past three years. The participants used a computer to go to the instructional website to learn about spyware and viruses then watched multimedia, streaming videos and followed the instructions to remove spyware and viruses.

To evaluate the effectiveness of this ID module, several instrumentation methods were used. The target audience were given a demographic survey, attitudinal survey, and pre and post-tests. Surveys with various types of questions were utilized to collect data from the target audience. A demographic survey containing six multiple-choice questions and two Liker-Scale questions was first given to obtain information about the learners and possible trends. The data also identified students' computer background knowledge and their attitude towards online learning.

Pre and post-test assessments containing up to 10 multiple-choice questions were used to evaluate the effectiveness of the modules. Attitudinal surveys containing four Likert-Scale questions were taken at the end of the class to determine each learners post attitude towards online learning, any continued interest in learning more about PC Repair, and how much they felt they have learned from the web-based modules.

Results

A total of 12 students registered for the researcher's PC Repair class and were anticipated to take the module; however, problems arose in acquiring that amount of data. One student could not participate because she did not come back from the mainland in time and another did not show up at all. On the day that the modules were administered, a student fell ill and could not attend class. Additionally, although the pre-tests, instructional content, and post-tests were segmented from each other within each web page, some students took only the pre-test and some took only the post-test. Thus, only eight of nine student responses for both spyware modules were used and six of nine responses for both virus modules were used. To avoid this issue in the future, the tests and content will be made completely separate from each other in different web pages.

The final testing group consisted of six males and three females. The demographic survey revealed that there were three students in the 18-29 years age group, one in the 30-39 age group, two in the 40-49 age group, and three in the 50-59 age group. There was also a mix of ethnicities; there were four Asians, four Whites, and one Hawaiian or Pacific Islander. All were comfortable with using computers as they had over five years of PC experience. Seven students took the class because they were interested in the topic, one took it because it would help them at work, and the last student took the class for both reasons.

Overall, the students did well. As a group, the total combined average for all four modules for the pre-tests was 48%, and the average post-score is 79%, a 31% increase (Figure 1). The median, the middle value in the list of scores, was 79%; the mode, the value that occurs most often, was 85%; and the range, the difference between the largest and smallest values, was 27%. The most dramatic increase was the fifth student's performance as the score jumped from 32% to 89%. Most students scored between 70% and 80% and only one scored above 90%. It was the researcher's intention to make the test questions challenging. Even the subject matter expert commented that it could be difficult for some test takers. Several questions contained multiple correct answers; two

questions contained eight choices in which four were correct. In addition, elements of spyware were embedded in the virus tests and vice versa, which seemed to have confused some people. After analyzing the data, some of the questions would better fit intermediate level PC Repair students rather than entry level. The questions will be revised to match the audience level in the future.

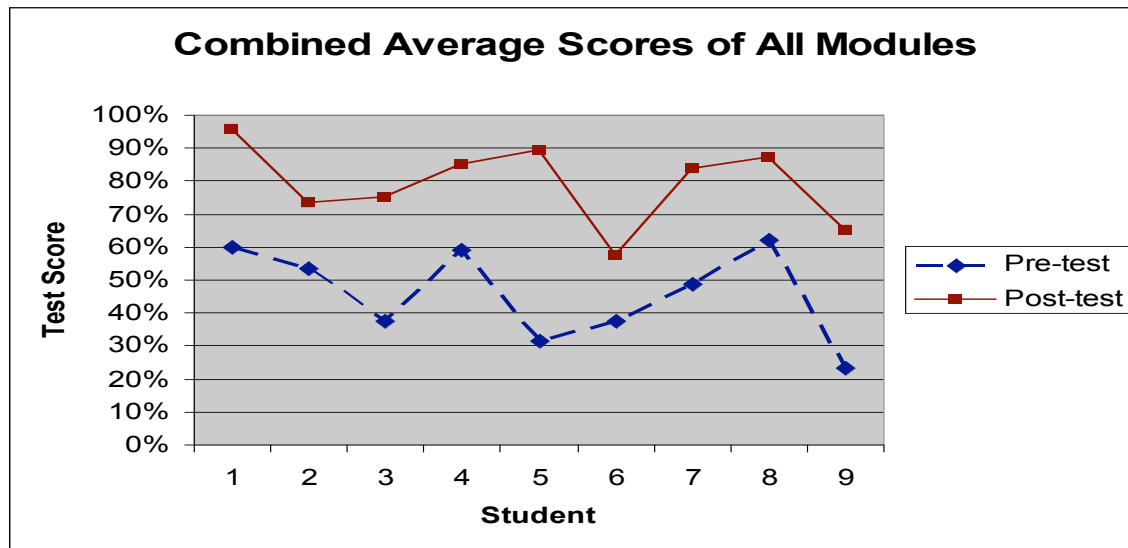


Figure 1. Combined average pre-test score versus post-test score of all modules.

Although their post-test scores were greater than their pre-test scores, two students fell below the 70% mastery expectancy. For the student who had a combined average post-test score of 65%, she scored in the 70% range for both spyware modules, 50% for the first virus module, and the second virus module was not taken. It is possible that the low score could be attributed to the lack of time to complete the last two modules. In addition, not being comfortable with online learning could be a factor as the student had stated in the demographics and attitudinal survey. The other student who scored low had a combined average post-test score of 58% and took all four modules. The learner scored in the 60% range for both spyware modules, 88% for the first virus module, and 20% for the last virus module. Interestingly, the student initially rated himself as comfortable with online learning before starting the module then very comfortable after completing it. He rated himself as not being knowledgeable with spyware and viruses in the attitudinal survey, yet commented that he liked the videos and felt like he was able to learn a lot. Additionally, he stated, "I think the tests really helped the things that I learned from the videos sink in." His impression could have been obtained by the one module he did well in and scored 88% in the post-test.

The two modules that incorporated only text and images had a combined average pre-test score of 49%, while the other two modules that used streaming video with narration was 46%. The combined average post-test score for the group was 79% for both types of modules. Thus, while similar, there was a slight greater differential in the video streaming module statistics when compared to the text and images module. For the video module, the average increase was 33%, the median was 83%, and the mode was 88%. For the text

and images module, the average increase was 30%, the median was 75%, and the mode was 82%. By looking at the median and mode scores, it is a possibility that the students learned better from watching videos and hearing narration rather than reading text and seeing images, but further research will need to be done to determine the accuracy of this theory.

There were several positive comments about the videos. One student said, "It was edited really well... specially the words was used non geek term so, everyone can understand and easy follow." Another stated, "Very helpful videos. Easy to understand and follow." "The videos helped as I was able to split screens and follow along as the video progressed," said another student. One initially had an issue and commented the following, "My first video had sound but no video and it stayed on the same frame the whole topic."

Unfortunately, there were a lot of unexpected technical issues that had to be resolved as they came up. One of the PCs that were being used had a faulty sound card. Fortunately, there was a spare PC available that the student used to take the module. A widespread problem that affected the majority of the students was that Internet Explorer could not load the streaming videos. Thus, Mozilla Firefox, another web browser, was downloaded and installed. Some PCs had old versions of Adobe Flash players and needed to be updated to display the videos. Although the videos were hosted on fast, reliable servers at screencast.com, the local network at the college was slow; some students had to wait a while before their video could stream to them. When everyone got to the second virus module where they followed the video to install and run AVG Anti-Virus, they were warned that they had to first remove McAfee Antivirus, which was pre-installed on the computer. Another issue came up as a few students were following the video to download spyware and virus software. Instead of clicking on the correct link as shown in the video, the students accidentally clicked on advertisements that had "Click here" on the banner and downloaded the wrong software. Despite these obstacles, most of the students were able to complete the module. Without the face-to-face interaction with the instructor; however, there would be a greater data deficiency. In the future, to mitigate most of the issues experienced in this project, two things will be done: a common baseline configuration of the PC hardware and required software will implemented, and the course pre-requisites will be amended so that students must have intermediate Microsoft Windows experience and can type well.

Students were also asked how comfortable they were with online learning before and after the modules in a survey; three students were very comfortable and had no change in their answer, three students shifted from comfortable to very comfortable, one changed from not comfortable to comfortable, and the level of comfortableness for the last two students decreased by one (Figure 2).

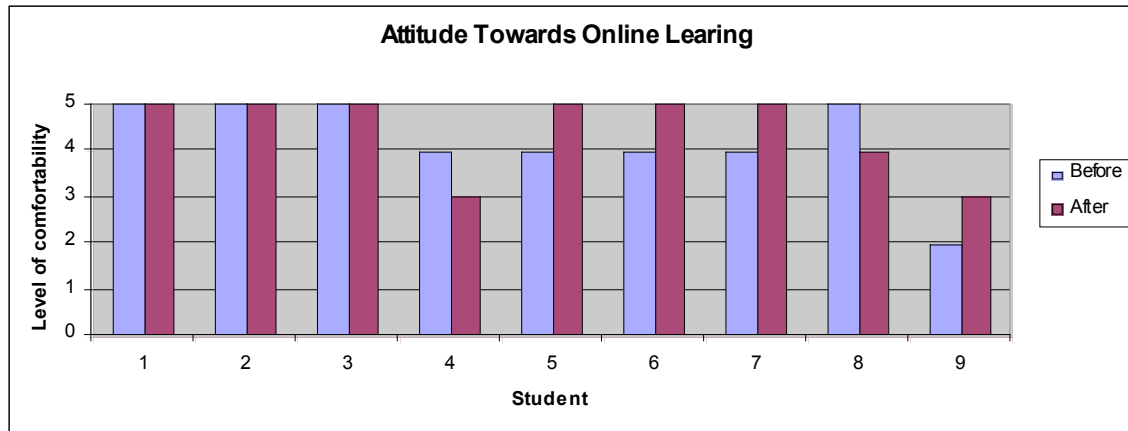


Figure 2. Attitude towards online learning before and after completing the module.

One of the two students whose attitude decreased said, “This was the first time for me with on-line learning.” Interestingly, that student initially said that they were comfortable with online learning, but then changed to a neutral feeling after completing the module. The student’s overall combined pre-test score was 59%, while the post-test was 85%, a 26% increase. The other student whose attitude that also decreased from very comfortable to comfortable scored well also. The overall combined pre-test score was 62%, while the post-test was 87%, a 25% increase. Thus, although both of their online learning attitudes shifted one level lower, they exhibited a good mastery of the subject matter.

When asked about their impressions of the website one student commented, “This was the first time for me with on-line learning. It was an experience, I liked going at your own speed and if you missed something you could go back and start over.” Other comments were, “It is pretty straight forward,” “Simple very informative,” “Easy to understand and navigate,” and “The items covered on the website were very good.” The only negative feedback received was in regard to the virus module where trojans and worms were briefly introduced, which left the student confused not knowing if they were a type of virus or different from it. More explanation in this area will alleviate any possible confusion.

Conclusion

With the guidance of the instructional design models and learning strategies, and the integration of web-based content to facilitate learning, it was the researchers focus to create an optimal web-based instruction for computer repair, specifically, knowledge of spyware and viruses and being able to remove them. The use of multimedia instruction was an effective teaching delivery method and student satisfaction can be attributed to it. From this project experience, it could be possible to teach this subject matter completely online without face-to-face interaction; however, issues will come up and workarounds must be in place for it to be successful. It is hoped that this instructional design module will help educate more learners and empower them to overcome issues they face with computers.

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